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ABSTRACT

Approaches to helping students remember concepts in secondary mathematics are presented. The eleven points listed are: 1) distinguishing between natural and whole numbers; 2) remembering isosceles triangles have two equal sides; 3) finding all possible pairs of integral factors of a given number; 4) recalling the meaning of reflexive, symmetric, and transitive properties; 5) distinguishing between abscissa and ordinate, domain and range; 6) graphing a conjunction on a number line; 7) graphing ellipses and hyperbolas; 8) distinguishing among vertical, alternate, and corresponding angles; 9) solving motion problems efficiently; 10) solving rate-of-work problems; and 11) remembering the formula for the measure of an angle formed by two chords intersecting in a circle. (MP)

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LEARNING AIDS

IN THE SECONDARY MATHEMATICS CURRICULUM

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When presenting a new topic to a math class, I make a point of developing it slowly, using the students' existing knowledge. Relevant vocabulary is introduced and used regularly. When the concept has been grasped, I often proceed to say, "Now here is a trick to help you remember." My students and I have developed the following aids that span the secondary mathematics curriculum.

1) To remember the difference between natural numbers $\{1,2,3,\ldots\}$ and whole numbers $\{0,1,2,\ldots\}$:

Remember that whole numbers includes the "hole" (zero).

2) To remember that an isisceles triangle has two equal sides:

Learn to spell I S O S C E L E S and visualize the two S's (for "side") flanking the one different letter.

3) To find <u>all</u> possible pairs of integral factors of a given number, useful when trying to factor a quadratic equation when the sum or difference of the factors is known:

Find <u>any</u> pair of factors for the number. Divide the larger by one of its integral factors and multiply the smaller by the same number in order to get another pair. Continue until you find the necessary sum or difference or until all possibilities have been exhausted. For example, factor 324 so that the difference between the factors is 27. Perhaps the most obvious factors are

(divide by 3)	18 x 18	(multiply by 3)
(multiply by 9)	6 x 54	(divide by 9--proved useless)
(divide by 2)	54 x 6	(multiply by 2)
(divide by 3)	27 x 12	(multiply by 3)
	9 x 36	The required factors

4) To remember the properties to which the words reflexive, symmetric, and transitive apply:

Remember the words in alphabetical order:

Reflexive involves one idea, one equal sign ($x = x$).

Symmetric involves two ideas, two equal signs (if $x = y$ then $y = x$).

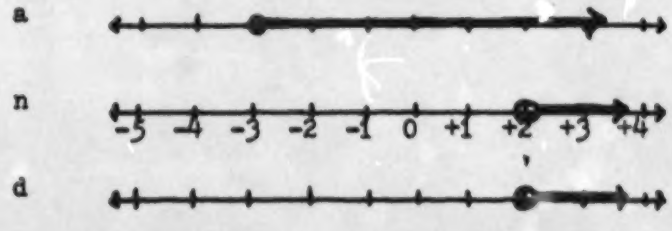
Transitive involves three ideas, three equal signs (if $x = y$ and $y = z$ then $x = z$).

5) To remember the difference between abscissa and ordinate, domain and range:

Remember the words in alphabetical order. They refer to x and y, respectively.

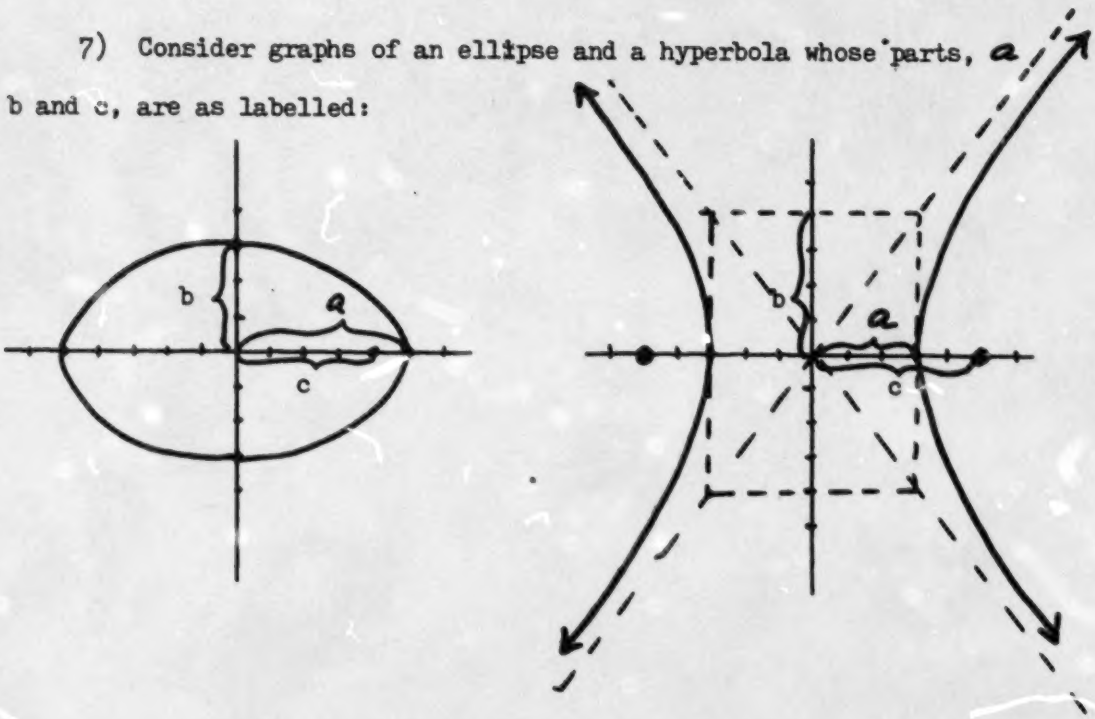
6) To graph an "and" statement (conjunction) on a number line:

Make a sketch using the letters a-n-d, standing for "above," "number line," and "down":



Consider $x \geq -3$ and $x > 2$. Graph the first part of the conjunction "above," the second part "down," and what is in common on the "number line."

7) Consider graphs of an ellipse and a hyperbola whose parts, a, b and c, are as labelled:



For an ellipse it is true that $a^2 = b^2 + c^2$. For a hyperbola it is true that $c^2 = a^2 + b^2$. To keep these ideas straight without always having to sketch the figure:

Remember that "c" stands for the distance from the center to the focus by thinking of the word "see." The equation for the ellipse begins with the letter (a) that looks most like an ellipse; hence, a is the longest of the three lengths. Similarly, the equation for the hyperbola begins with the letter (c) that looks most like a hyperbola, and c is the longest of the three lengths.

8) To distinguish among and illustrate vertical angles, alternate angles, and corresponding angles, I always put the following illustration on the board, in two colors:

v e r t i c a l a l t e r n a t e c o r r e s p o n d i n g

We thereafter always refer to the "cross," the "Z," or the "F" when looking for these angles.

9) To solve motion problems efficiently:

I have ceased distinguishing among vehicles travelling toward each other, in opposite directions, and one overtaking the other. Instead, I develop the formula r x t = d, the idea of creating a table

	r	t	d
vehicle 1			
vehicle 2			

and arm my students with one set of rules which may be used successfully with virtually every one-variable motion problem encountered in Algebra I. (Note that I do explain to them that there are alternate ways of setting up the table which may yield simpler algebraic equations. I <u>always</u> encourage alternate methods of solution.)

1. Place the variable according to the question so that when you have solved the equation you will immediately have the answer to the question. Complete <u>that</u> column according to information in the problem. (It is essential to distinguish between "column" and "row.")
2. Fill in another column entirely with numbers given in the problem.

3. Fill in the third column by multiplying (if "d" is empty) or dividing the two completed columns.

4. Using THE LAST COLUMN YOU FILLED IN, along with some information NOT YET USED, create an equation and solve.

10) To solve rate-of-work problems:

Create seven "let" statements:

time together (the time worked by each in the final situation)

$time_1$ (the time it would take the first person alone)

$time_2$ (the time it would take the second person alone)

$fraction_1$ (the fraction of the job the first person does each hour or unit of time)

$fraction_2$ (the fraction of the job the second person does each hour or unit of time)

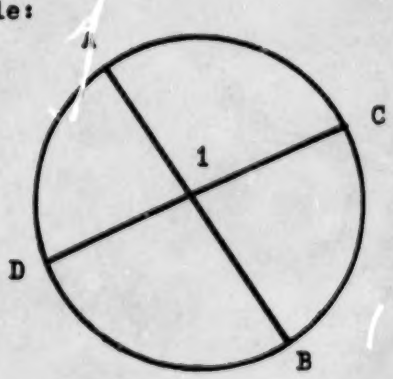
$work_1$ ($fraction_1$ multiplied by the time worked in the final situation)

$work_2$ ($fraction_2$ multiplied by the time worked in the final situation)

The equation: $work_1 + work_2 = 1$

11) To remember the formula needed to determine the measure of an angle formed by two chords intersecting in a circle:

Visualize the <u>cross</u> made by the two chords as a <u>plus sign</u> to distinguish it from all of the other formulas involving difference of arcs. Thus, $\measuredangle 1 = \frac{1}{2}(\overset{\frown}{AC} + \overset{\frown}{BD})$.



These learning aids and others like them have not only enabled many students to achieve success in topics where they would not have otherwise, but they have also sparked a special kind of interest so fundamental to successful learning. Once a student has been introduced to such methods, he, too, becomes a creater. Pride in discovering a technique which will help another student affords him the opportunity of experiencing the true rewards of successful teaching.